Small Business Innovation Research/Small Business Tech Transfer

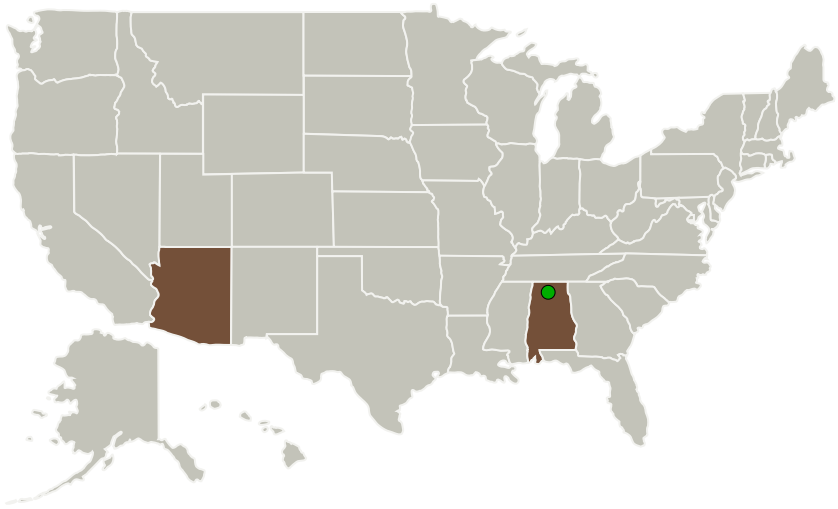
Fabric, Inflated, Insulating Shroud for Cryogenic In-Space Transportation, Phase I

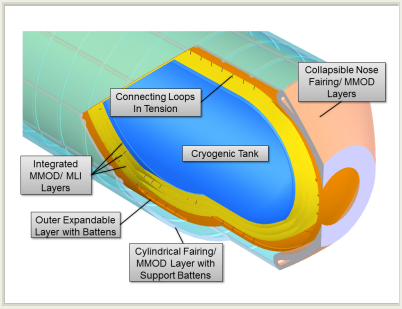
Completed Technology Project (2015 - 2015)

Project Introduction

Paragon Space Development Corporation (Paragon) and our subcontractor, Thin Red Line Aerospace (TRLA) propose a unique solution for an inflated shroud system that provides launch, ascent, on-orbit, and transit protection to a large cryogenic tank. The system consist of an outer inflated shroud that surrounds nested, concentric integrated ballistic/radiation shields separated by a series of loops via tension that are deployed by gas released between the perforated layers causing gentle inflation upon reaching the vacuum of space. Battens within the shroud maintain its form even when unpressurized, and the frustum is protected with soft-goods thermal protection; the shroud is not jettisoned but rather carried into space to act as the outer micro-meteoroid orbital debris (MMOD) bumper and insulation layer. The tension based loop system allows tailored separation of the layers for optimal MMOD and thermal protection. The loops support small tensile loads and have a high length-to-cross-sectional-area ratio reducing conduction between layers for performance near idealized MLI; improving on foam spacers, scrim, or other compression standoffs. Tank supports and plumbing pass through cutouts in the deployed system with little effect to thermal or ballistic protection. The architecture can encapsulate a tank or support deep space radiation cooled conical or complex geometry shields. Paragon and TRLA are confident this unique multifunctional system concept will lead to a higher performance, lower cost, and lower mass solution than is currently possible with existing shrouds, MMOD, and insulation systems.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Arizona

Project Transitions

June 2015: Project Start

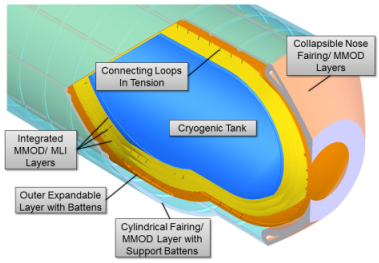
December 2015: Closed out

Closeout Summary: Fabric, Inflated, Insulating Shroud for Cryogenic In-Space Transportation, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138857)*

Images



Briefing Chart Image
Fabric, Inflated, Insulating Shroud for Cryogenic In-Space Transportation, Phase I *(https://techport.nasa.gov/image/135616)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Paragon Space Development Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

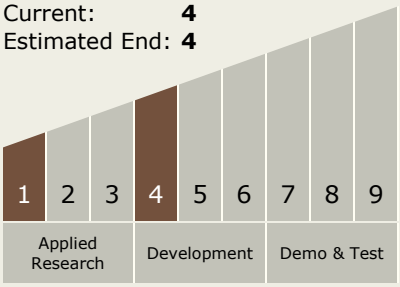
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Chad E Bower

Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System